

CLAIMS

1. An isolated Nod-factor binding element comprising one or more isolated Nod-factor binding polypeptide (NFR polypeptide) having a specific Nod-factor binding property, or a functional fragment thereof, wherein the amino acid sequence of said NFR polypeptide is at least 60% identical to any one of SEQ ID No: 8, 15, or 25.
2. The Nod-factor binding element of claim 1, wherein said NFR polypeptide is NFR1, comprising the amino acid sequence selected from the group consisting of SEQ ID No: 24, 25, 52 and 54.
3. The Nod-factor binding element of claim 1, wherein the NFR polypeptide is NFR5 comprising an amino acid sequence selected from the group consisting of SEQ ID No: 8, 15, 32, 40, and 48.
4. The Nod-factor binding element of claim 1, comprising:
 - a. a NFR polypeptide, or a functional fragment thereof, wherein the amino acid sequence of said NFR polypeptide is at least 60% identical to SEQ ID No: 24 or 25; and
 - b. a NFR polypeptide or a functional fragment thereof, wherein the amino acid sequence of said NFR polypeptide is at least 60% identical to a sequence selected from the group consisting of SEQ ID No: 8, 15, and 32.
5. The Nod-factor binding element of claim 1, comprising:
 - a. the NFR polypeptide that is NFR1 or a functional fragment thereof, having the amino acid sequence selected from the group consisting of SEQ ID No: 24, 25, 52, and 54, and

- b. the NFR polypeptide that is NFR5 or a functional fragment thereof, having an amino acid sequence selected from the group consisting of SEQ ID No: 8, 15, 32, 40, and 48.
6. An isolated nucleic acid molecule encoding a NFR polypeptide according to claim 1, wherein the NFR amino acid sequence is at least 60% identical to either of SEQ ID No: 8, 15, or 25.
7. An isolated nucleic acid molecule encoding a NFR 1 polypeptide according to claim 2, comprising the amino acid sequence selected from the group consisting of SEQ ID No: 24, 25, 52, and 54.
8. An isolated nucleic acid molecule encoding a NFR 5 polypeptide according to claim 3, comprising an amino acid sequence selected from the group consisting of SEQ ID No; 8, 15, 32, 40, and 48.
9. An isolated nucleic acid molecule which encodes a Nod-factor binding polypeptide of a Nod-factor binding element, wherein said nucleic acid molecule hybridizes with a nucleic acid molecule comprising a nucleotide sequence selected from the group consisting of SEQ ID No: 6, 7, 11, 12, 21, 22, 23, 39, 47, 51, and 53 under stringency conditions of no less than about 1.0xSSC at 65° C.
10. An expression cassette comprising a nucleic acid molecule encoding an NFR polypeptide having a specific Nod-factor binding property, or a functional fragment thereof, having an amino acid sequence
 - a) at least 60% identical to SEQ ID No: 8, 15, or 25;
 - b) selected from the group consisting of SEQ ID No: 8, 15, 24, 25, 32, 40, 48, 52, and 54; or

- c) encoded by a nucleic acid molecule that hybridizes with a nucleic acid molecule comprising a nucleotide sequence selected from the group consisting of SEQ ID No: 6, 7, 11, 12, 21, 22, 23, 39, 47, 51, and 53 under stringency conditions of no less than about 1.0xSSC at 65°C.
11. An expression cassette comprising a nucleic acid molecule according to claim 6.
12. The expression cassette of claim 10, wherein the nucleic acid molecule encoding a NFR polypeptide is operably linked to a transcriptional regulatory element.
13. A vector comprising the expression cassette of claim 12.
14. A cell that is stably transformed with the expression cassette of claim 12.
15. The cell according to claim 14, wherein said cell is a plant cell.
16. A method of producing a plant expressing a Nod-factor binding element, the method comprising introducing into the plant a transgenic expression cassette comprising a nucleic acid sequence encoding a NFR polypeptide or functional fragment thereof having an amino acid sequence
- a) selected from the group consisting of SEQ ID No: 8, 15, 24, 25, 32, 40, 48, 52, and 54;
 - b) at least 60% identical to SEQ ID No: 8, 15, 25, or 32;
 - c) comprising SEQ ID No: 8, 15, 24, 25, 32, 40, 48, 52, or 54; or
 - d) encoded by a nucleic acid molecule that hybridizes with a nucleic acid molecule comprising a nucleotide sequence selected from the group consisting of SEQ ID No: 21, 22, 23, 51, and 53 under stringency conditions of no less than about 1.0xSSC at 65°C;

wherein the nucleic acid sequence is operably linked to a promoter, and selecting transgenic plants and their progeny expressing said NFR polypeptide.

17. The method of claim 16, wherein the transgenic expression cassette is introduced into the plant through a sexual cross.
18. The method of claim 16, wherein said promoter is a native or heterologous root specific promoter.
19. The method of claim 16, wherein said promoter is a native or heterologous constitutive promoter.
20. A transgenic plant expressing one or more NFR polypeptides produced according to the method of claim 16.
21. The transgenic plant of claim 20, having a specific rhizobial strain recognition.
22. The transgenic plant of claim 20, wherein the plant is a non-nodulating dicotyledonous plant.
23. The transgenic plant of claim 22, wherein the plant is a non-nodulating monocotyledonous plant.
24. The transgenic plant of claim 23, wherein said monocotyledonous plant is a cereal.
25. A method for marker assisted breeding of *NFR* alleles, encoding variant Nod-factor binding polypeptides (NFR polypeptides), comprising the steps of:
 - a. determining the nodulation frequency of legume plants expressing a variant NFR polypeptide having specific Nod-factor binding properties and having an amino

- acid sequence at least 60% identical to a sequence selected from the group consisting of SEQ ID No: 8, 15, 24, 25, 32, and
- b. identifying a DNA polymorphism at a locus genetically linked to or within the allele encoding said variant NFR polypeptide, and
 - c. preparing a molecular market based on said DNA polymorphism, and
 - d. using said molecular marker for the identification and selection of a plant carrying an *NFR* allele encoding said variant NFR polypeptide.
26. The method according to claim 27, wherein said variant NFR polypeptide has an amino acid sequence substantially similar to a sequence selected from the group consisting of SEQ ID No: 8, 15, 24, 25, 32, 40, 48, 52, and 54.
27. A plant selected according to the method of claim 24, carrying a *NFR* allele encoding a variant NFR polypeptide.
28. The method of claim 24 wherein the selected plant has enhanced nodulation frequency and/or root nodule occupancy and/or enhanced symbiotic nitrogen fixation ability relative to a control plant comprising a non-variant NFR allele.
29. The method according to claim 28, wherein said plant is a legume.